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(54) **Electrical connection box for use in a car**

(57) An electrical connection box for use in a vehicle, e.g. a car, has a junction box (10) and a circuit addition box (11) removably mounted on the junction box (10) and having a connector engaging portion (16) for engagement in use by a connector (20) of an external circuit, the circuit addition box having bus bars (13,14) connecting circuit components of the junction box to the

connector engaging portion (16) to provide electrical connection to said external circuit. To achieve a compact arrangement, avoiding the need to adapt the junction box, the circuit addition box (11) is removably mounted on a relay housing (12A) of the junction box (10) adapted to receive a relay, the relay housing (12a) having electrical terminals (22) engaged by the bus bars (13,14) of the circuit addition box.

Fig. 7

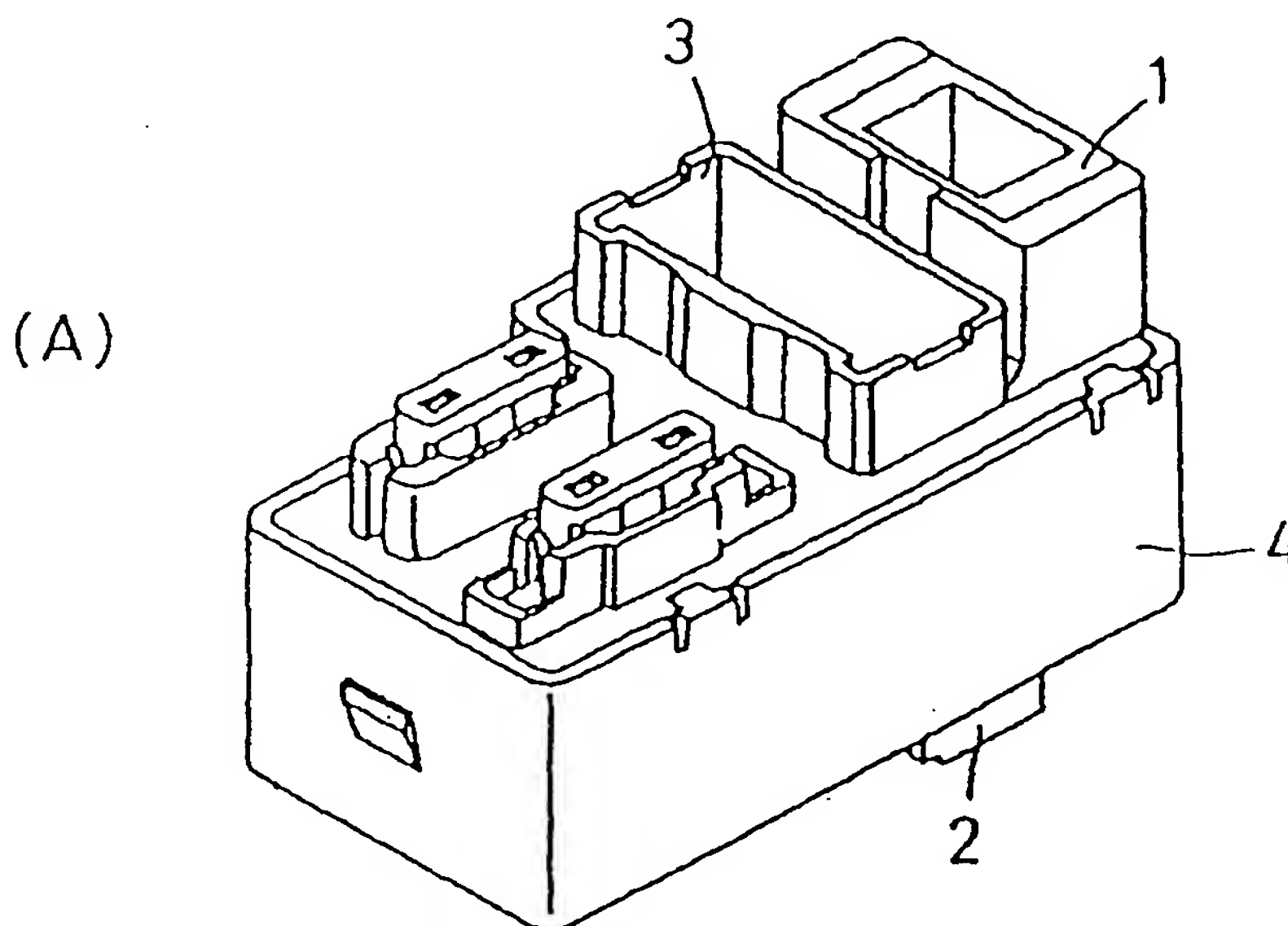
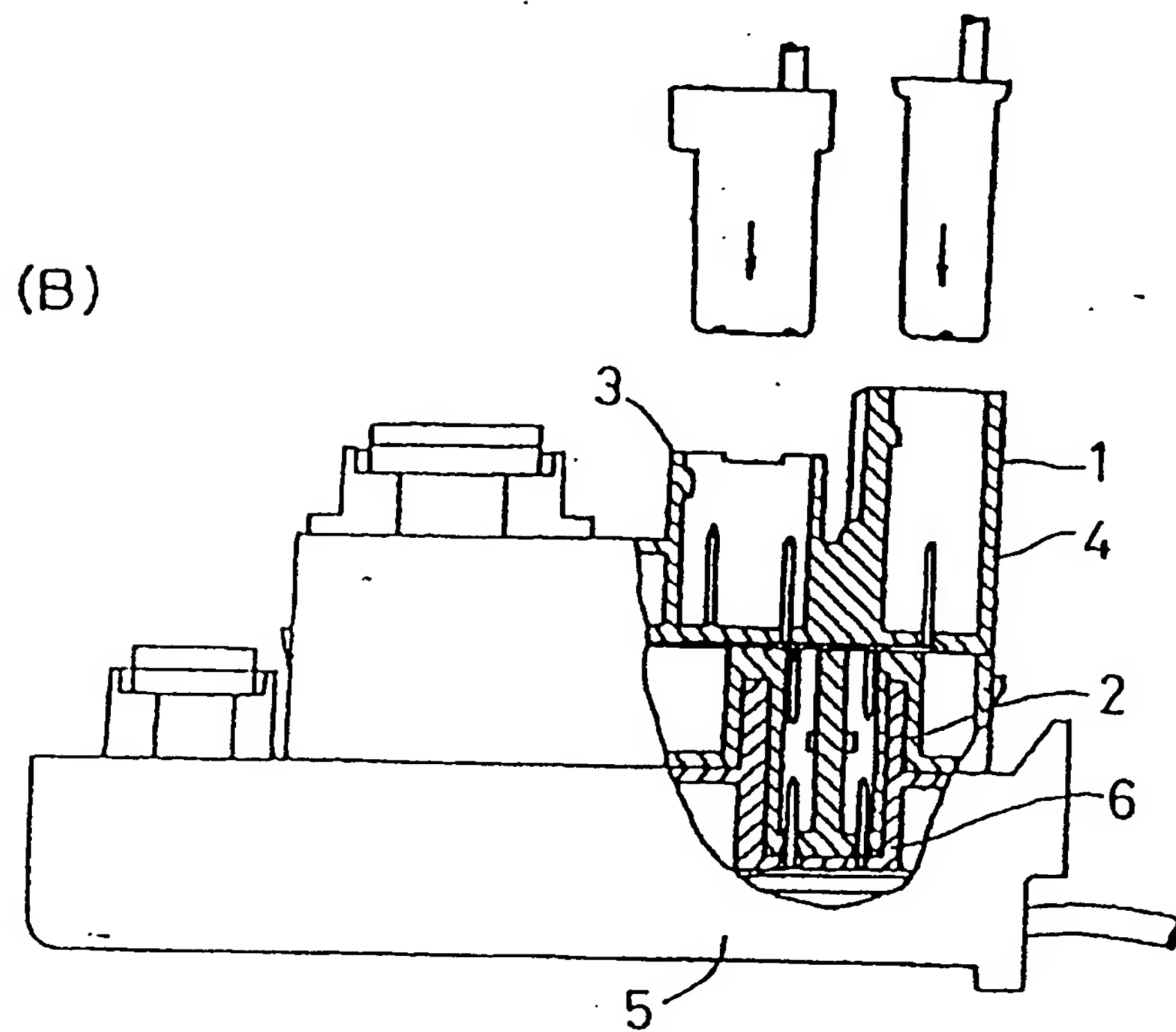
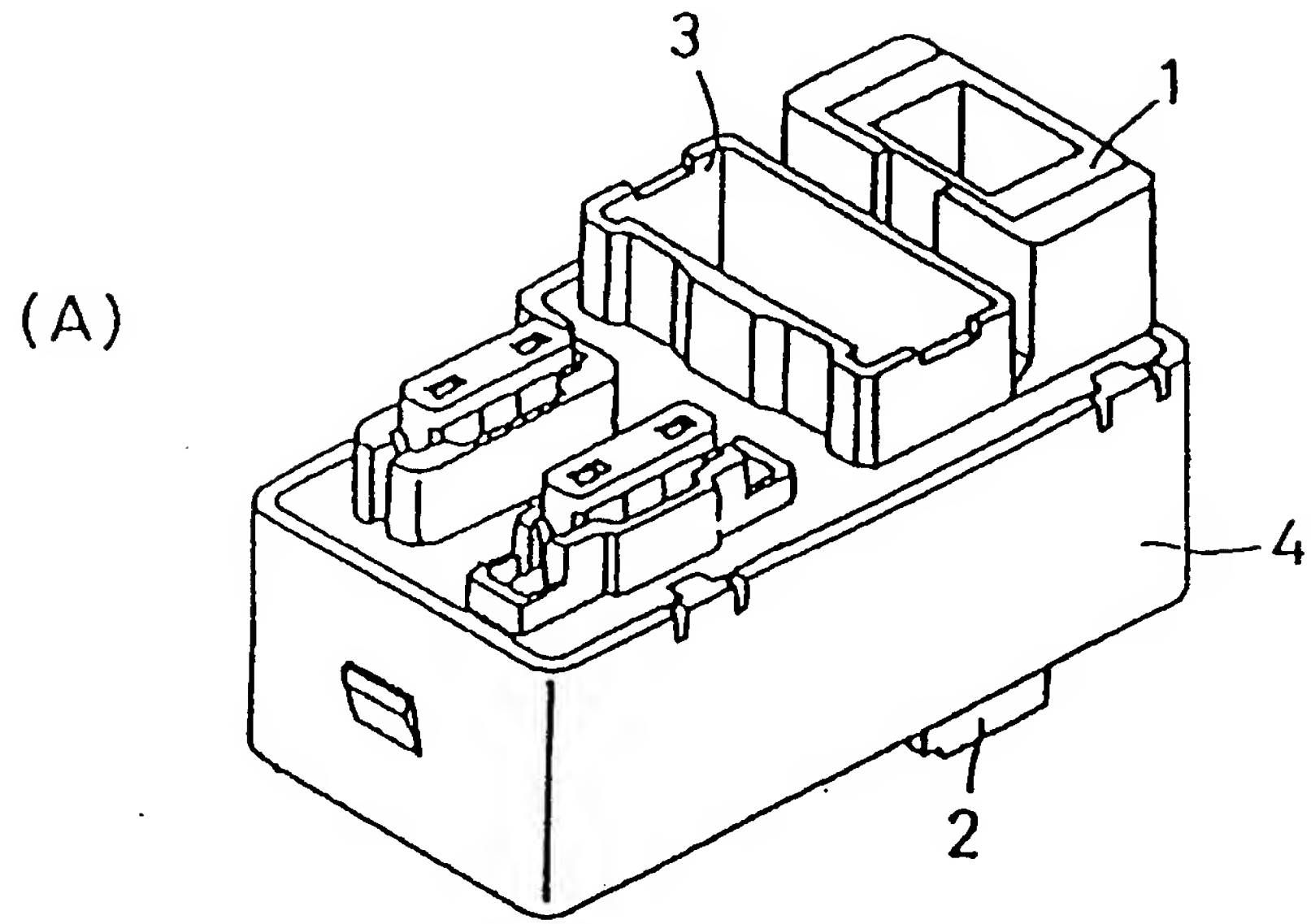


Fig. 7



as to efficiently accommodate the bus bars therebetween. Thus, the electrical connection box for use in a car has a simple construction and is compact, thus not occupying a large space. The circuit addition box preferably does not interface with the fitting of components onto an adjacent relay housing or housings of the junction box. A fuse or fuses for the added circuit may be provided in the junction box.

Preferably, the circuit addition box comprises a first and a second box portions locked to each other; the first box portion and the relay housing are locked to each other, with the first box providing the relay housing engaging portion and the second box portion comprising the electrical connector engaging portion. In this construction, after the bus bars are accommodated in the first box, the first box is covered by the second box to sandwich the bus bars between the first box and the second box, with the bus bars projecting into the electrical connector engaging portion.

It is necessary to insert one end of each of the bus bars accommodated inside the circuit addition box into the relay housing and project the other end of each of the bus bars into the connector engaging portion. Thus, it is necessary to hold the intermediate part of each of the bus bars. Further, it is necessary to provide the circuit addition box with the portion engaging the relay housing and the portion engaging a connector. In order to meet these requirements and allow the circuit addition box to have a compact and simple construction, the circuit addition box is divided into the first and second box portions, and the bus bars are sandwiched in the connection between the first and second box portions.

Preferably, the circuit addition box comprises the first box portion, the second box portion, and a hinge interposed therebetween, all formed in one-piece by monolithic molding of a plastics material. It is possible to form the first box portion and the second box portion separately from each other and cover the first box portion with the second box portion and lock them to each other, after the bus bars are accommodated in the first box portion. But the first and second box portions formed by monolithic molding of a plastics material allows a small number of parts to be used and assembling operation to be easily accomplished.

With reference to a horizontal base of the junction box, preferably each of the bus bars accommodated in the circuit addition box comprises a bent metal element having a vertical first portion providing an internal circuit connection terminal inserted into a relay terminal insertion opening formed on the relay housing, a horizontal second portion adjoining the internal circuit connection terminal and continuous therewith, and a third vertical portion providing the external circuit connection terminal adjoining the continuous portion and continuous therewith, thus projecting into the connector engaging portion. In this construction, the second horizontal portion is sandwiched between the first and second box portions.

## BRIEF DESCRIPTION OF THE DRAWINGS

These and other optional features of the present invention will become clear from the following description of the preferred embodiments thereof given with reference to the accompanying drawings throughout which like parts are designated by like reference numerals, and in which:

Fig. 1 is a plan view of an electrical connection box for use in a car, embodying the present invention; Fig. 2 is front view of main portions of the electrical connection box shown in Fig. 1;

Fig. 3A is a front view showing a state in which first and second boxes of a circuit addition box of the connection box shown in Fig. 1 are opened;

Fig. 3B is a plan view showing the state in which the first and second boxes shown in Fig. 3A are opened;

Fig. 3C is a bottom view showing the state in which the first and second boxes shown in Fig. 3A are opened;

Fig. 4A is a side view showing a bus bar which is accommodated in the circuit addition box of Figs. 3A-3C;

Fig. 4B is a plan view of the bus bar shown in Fig. 4A;

Fig. 4C is front view of the bus bar shown in Fig. 4A; Fig. 5A is a side view of another bus bar which is accommodated in the circuit addition box of Figs. 3A-3C;

Fig. 5B is a plan view of the bus bar shown in Fig. 5A;

Fig. 5C is front view of the bus bar shown in Fig. 5A;

Fig. 6 is a sectional view showing a state in which the circuit addition box of Figs. 3A-C is mounted on a relay housing of a junction box;

Fig. 7A is a perspective view showing a prior art junction box; and

Fig. 7B is a front view partly in section showing a state in which the prior art compact junction box of Fig. 7A is connected with the body of another junction box.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

An electrical connection box, for use in a car, of the present invention is described below with reference to Figs. 1 to 6. Fig. 1 shows a junction box 10 and a circuit addition box 11, respectively. When it is desired to add a circuit to an existing circuit due to the addition of a system to an existing system, the circuit addition box 11 is installed on an unused relay housing 12A which is one of a plurality of relay housings 12A, 12B, ... mounted on the upper surface of the junction box 10.

The relay housing 12A is adapted to be used for a micro ISO relay. Thus, a portion of the circuit addition

box 11 to be mounted on the relay housing 12A has a shape similar to that of the micro ISO relay; and the position of a pair of bus bars 13 and 14 of the circuit addition box is such that the ends of the bus bars 13 and 14 to be inserted into the relay housing 12A are coincident with the terminals of the micro ISO relay. The bus bars 13 and 14 are accommodated in the circuit addition box 11.

Referring to Figs. 3A, 3B, and 3C, by monolithic molding, a suitable plastics material is formed into the circuit addition box 11 comprising a first box 15, a second box 16, and a thin living hinge 17 connecting between the first and second boxes 15 and 16. The first box 15 and the second box 16 are locked to each other as follows: after the bus bars 13 and 14 are accommodated in the first box 15, the first box 15 is covered by the second box 16 by mutual pivoting at the hinge 17. Then, a locking claw 15a formed on the peripheral wall of the first box 15 is locked to a locking hole 16a formed on the second box 16.

Referring to Figs. 2, 3A, 3B, and 3C, the construction of the first box 15 is described. The first box 15 has an upright rectangular hollow portion 15b which is fitted on the relay housing 12A standing up on the upper surface of the junction box 10. Bus bar insertion holes 15d and 15e are formed on an upper wall 15c of the cylindrical portion 15b. As described above, one side of the upper wall 15c is connected with the second box 16 through the thin hinge 17. The hollow portion 15b has a locking groove 15f formed thereon. A locking claw 12a projecting from the peripheral wall of the relay housing 12A is locked to the locking groove 15f.

In this construction, the circuit addition box 11 is supported on the junction box 10 solely by the relay housing 12A. The circuit addition box is very compact and does not extend much beyond the relay housing 12A, as seen in plan view. It does not interfere with the fitting of another component on the adjacent relay housing 12B. Its lower part consists essentially of the box position 15 which closely surrounds the relay housing 12A.

The construction of the second box 16 is now described. When the first box 15 is covered with the second box 16, a bottom wall 16b of the second box 16 is connected with the upper wall 15c of the first box 15, with the bottom wall 16b located on the upper wall 15c. A connector engaging portion 16c projects from one side of the bottom wall 16b. Bus bar insertion holes 16d and 16e are formed on the bottom surface of the connector engaging portion 16c. Referring to Fig. 6, a recess 16f formed on the bottom wall 16b accommodates the horizontal middle portions of the bus bars 13 and 14, with the bus bars 13 and 14 sandwiched between the upper wall 15c of the first box 15 and the bottom wall 16b. A locking strip 16g projects from the peripheral wall of the bottom wall 16b at the side opposite to the side thereof connected with the hinge 17. A locking claw 16h formed at the leading end of the locking strip 16g en-

gages a locking claw 10a formed on the junction box 10.

The bus bars 13 and 14 which are accommodated in the recess 16f formed on the bottom wall 16b of the second box 16 have a configuration shown in Figs. 4 and 5, respectively. That is, the bus bar 13 is a bent metal element and comprises a vertical internal circuit connection terminal 13a which is inserted into a relay terminal insertion opening 12b formed on the relay housing 12A, a horizontal continuous middle portion 13b bent from the internal circuit connection terminal 13a and continuous therewith, and a vertical external circuit connection terminal 13c bent from the continuous portion 13b and continuous therewith, thus projecting into the connector engaging portion 16c. Similarly, the bus bar 14 comprises a vertical internal circuit connection terminal 14a which is inserted into the relay terminal insertion opening 12b formed on the relay housing 12A, a horizontal continuous portion 14b bent from the internal circuit connection terminal 14a and continuous therewith, and a vertical external circuit connection terminal 14c bent from the continuous portion 14b and continuous therewith, thus projecting into the connector engaging portion 16c. The horizontal continuous middle portions 13b and 14b are accommodated in the recess 16f (see Fig. 6) of the bottom wall 16b, with the continuous portions 13b and 14b sandwiched between the upper wall 15c of the first box 15 and the bottom wall 16b of the second box 16.

In order to connect a general-purpose external connector 20 shown in chain-dot lines in Fig. 6 with the connector engaging portion 16c of the second box 16, the connector 20 with its external electrical wires w is inserted into the connector engaging portion 16c into which the external circuit connection terminals 13c and 14c of each of the bus bars 13 and 14 project. A terminal-accommodating chamber of the connector 20 accommodates female terminals (not shown in Fig. 6) connected with the wires w by compression. When the connector engaging portion 16c engages the connector 20, the female terminals engage the tab-shaped external circuit connection terminals 13c and 14c of each of the bus bars 13 and 14c. In this manner, the circuit addition box 11 and the external connector 20 are electrically connected with each other.

Referring to Fig. 6, through a relay terminal 21, the tab-shaped internal circuit connection terminals 13a and 14a inserted into the relay terminal insertion opening 12b of the relay housing 12A are electrically connected with a pair of tabs 22 projecting from bus bars of the internal circuit of the junction box 10. Because one of the tabs 22 is connected with the relay terminal 21, it is always connected with a power circuit. Thus, when one of the tabs 22 is connected with the bus bar 13 accommodated inside the circuit addition box 11 through the relay terminal 21, the bus bar 13 is supplied with an electrical power.

Using the electrical connection box for use in a car having the above-described construction, a new circuit



can be added to the existing internal circuit of the junction box 10 by merely mounting the circuit addition box 11 on the unused relay housing 12A of the junction box 10 when a new system is desired to be added to the existing system. When adding the new circuit, it is unnecessary to alter the construction of the existing internal circuit of the junction box 10.

That is, after the bus bars 13 and 14 are inserted into the first box 15 of the circuit addition box 11, the locking claw 15a of the first box 15 is locked to the locking hole 16a of the second box 16, with the first box 15 covered with the second box 16. Then, the locking claw 12a of the relay housing 12A is locked to the locking groove 15f of the first box 15. Then, the locking claw 16h of the locking strip 16g engages the locking claw 10a of the junction box 10. In this manner, the power circuit can be connected with the added circuit. Thereafter, the connector 20 connected with the external electrical wire is inserted into the connector engaging portion 16c of the circuit addition box 11 to connect the connector 20 to the second box 16. In this manner, the added system is supplied with an electrical power from the junction box 10 through the electrical wires w.

The present invention is not limited to the above-described embodiment. For example, the relay housing 12A on which the circuit addition box 11 is installed is not limited to the one which is used for a micro ISO relay, but a circuit addition box may be installed on any relay housings provided on the junction box 10.

As apparent from the foregoing description, when the alteration or addition of a circuit is desired because of the addition of a system, the electrical connection box for use in a car having the above-described construction allows the power circuit to be connected with the added circuit not by altering the construction of the existing internal circuit inside the junction box, but by merely mounting the circuit addition box on the unused relay housing of the junction box.

Further, the added circuit can be added to the existing internal circuit of the junction box, thus avoiding using an electrical wire for connecting the added circuit with a remote power source. Thus, it is unnecessary to increase the diameter of a wire harness. Therefore, the wire harness can be reliably wired in a car body. In addition, it may be unnecessary to prepare long electrical wires, which can avoid the increase in manufacturing cost.

Although the preferred embodiments of the present invention have been described with reference to the accompanying drawings, it is to be noted that various changes and modifications are apparent to those skilled in the art and are to be understood as included within the scope of the present invention.

## Claims

1. An electrical connection box for use in a vehicle

having a junction box (10) and a circuit addition box (11) which is removably mounted on the junction box (10) and has a connector engaging portion (16) for engagement in use by a connector (20) of an external circuit, the circuit addition box having bus bars (13,14) connecting circuit components of the junction box to said connector engaging portion (16) to provide electrical connection to said external circuit, characterized in that said circuit addition box (11) is removably mounted on a relay housing (12A) of said junction box (10) adapted to receive a relay, said relay housing (12a) having electrical terminals (22) engaged by said bus bars (13,14) of the circuit addition box.

2. An electrical connection box according to claim 1 wherein said circuit addition box has first and second box portions (15,16) locked to each other, the first box junction being mounted on the relay housing (12A) and the second box portion providing said connector engaging portion, the bus bars (13,14) being sandwiched between the locked together first and second box portions (15,16) and projecting into said connector portion.
3. An electrical connection box according to claim 2 wherein said first and second box portions (15,16) are connected together by a hinge (17) permitting their mutual pivoting into their locked together position, the first and second box portions and said hinge (17) being monolithically molded as one piece in plastics material.
4. An electrical connection box according to claim 2 or claim 3 wherein said junction box (10) has a base, and said bus bars (13,14) are each a bent metal element having a first portion perpendicular to said base and projecting into a relay terminal opening of said relay housing (12A), a second portion parallel to said base sandwiched between said first and second box portions (15,16) and a third perpendicular to said base projecting into said connector engaging portion.

Fig. 1

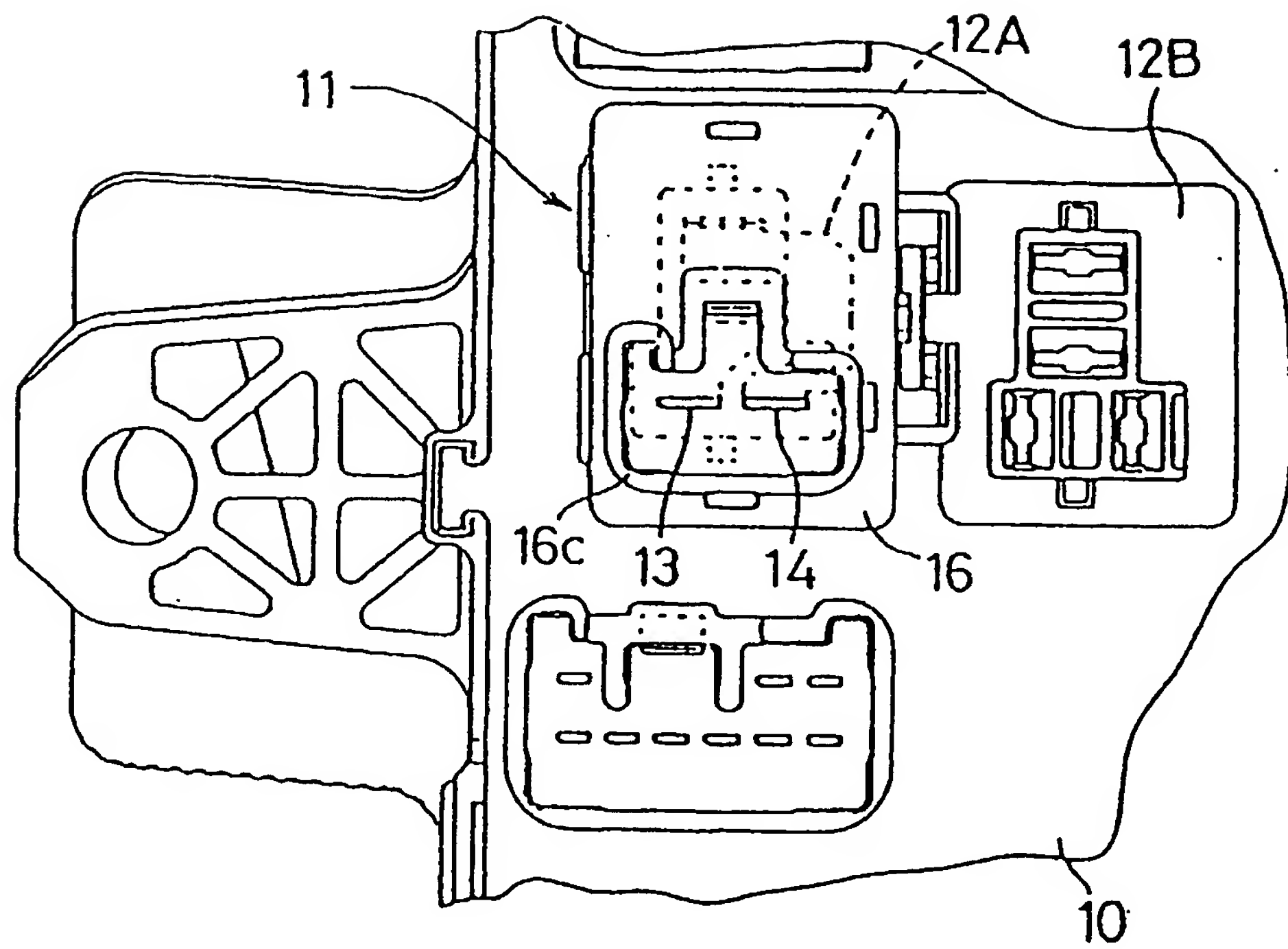


Fig. 2

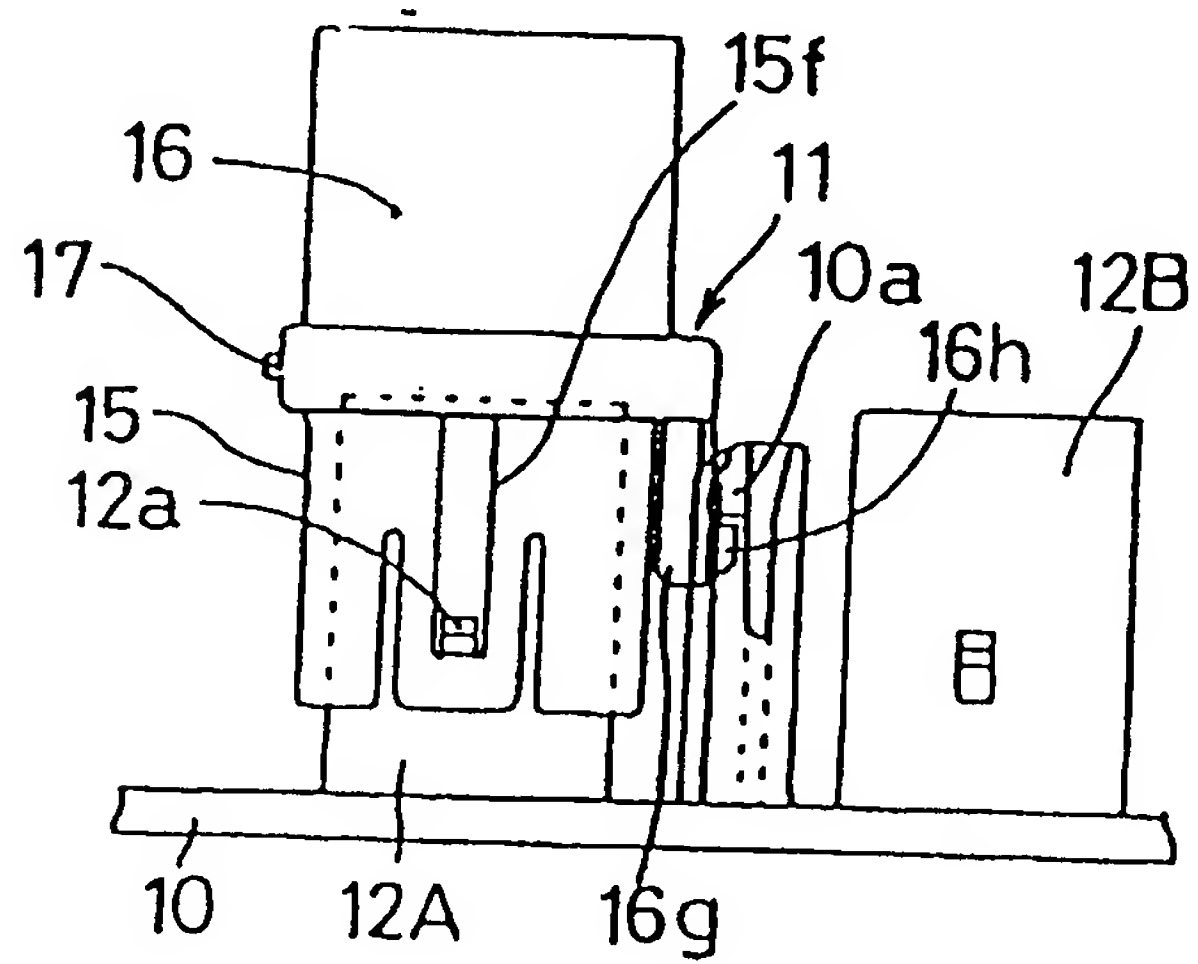


Fig. 3

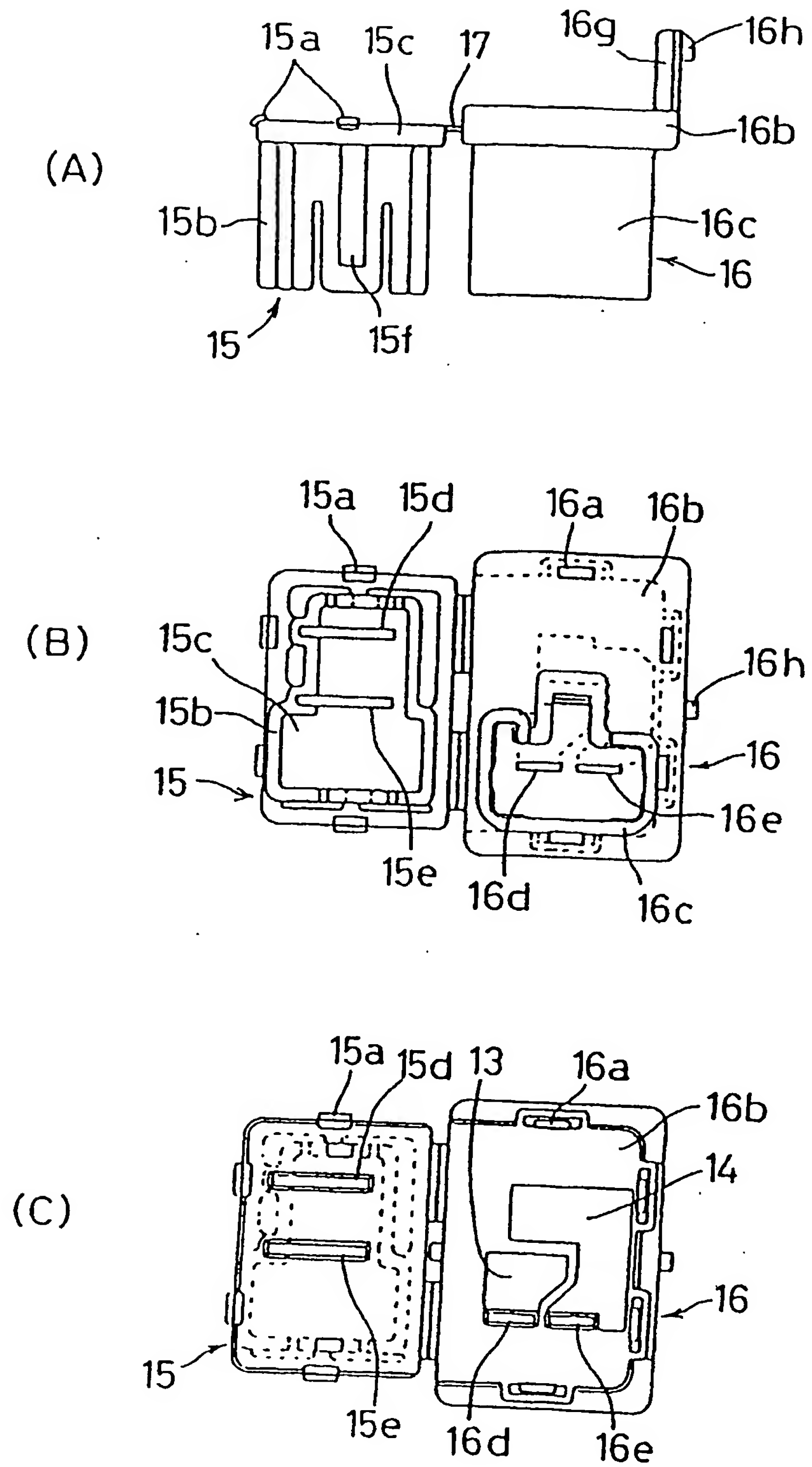


Fig. 4

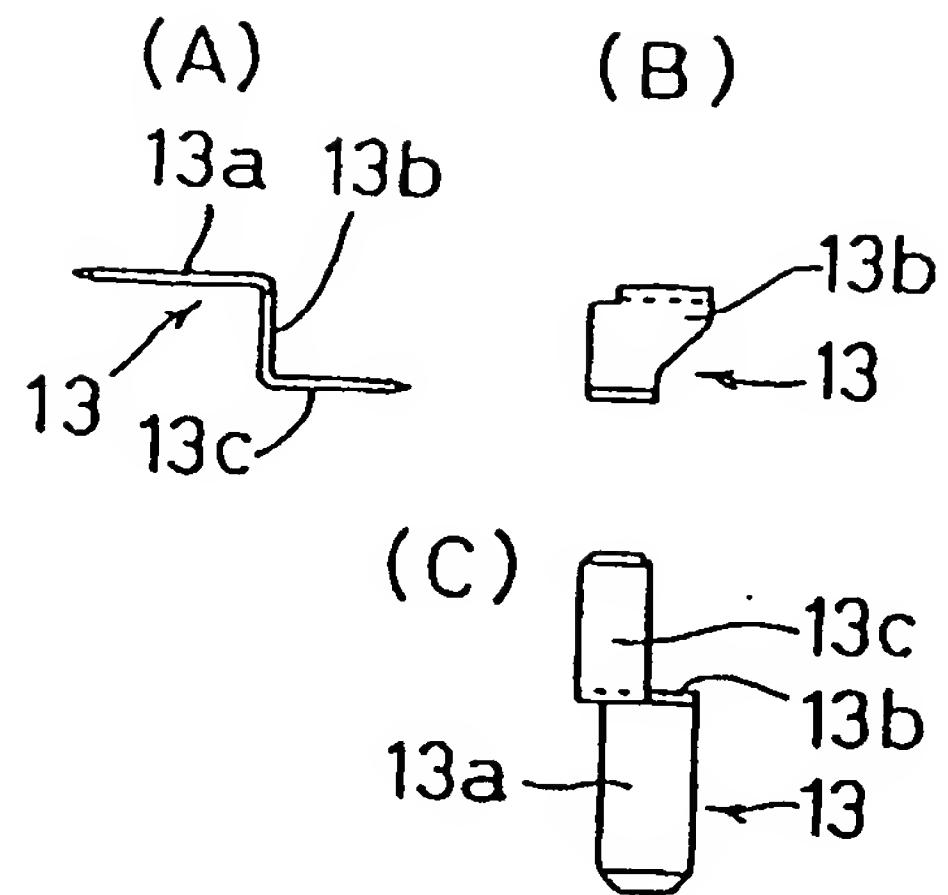


Fig. 5

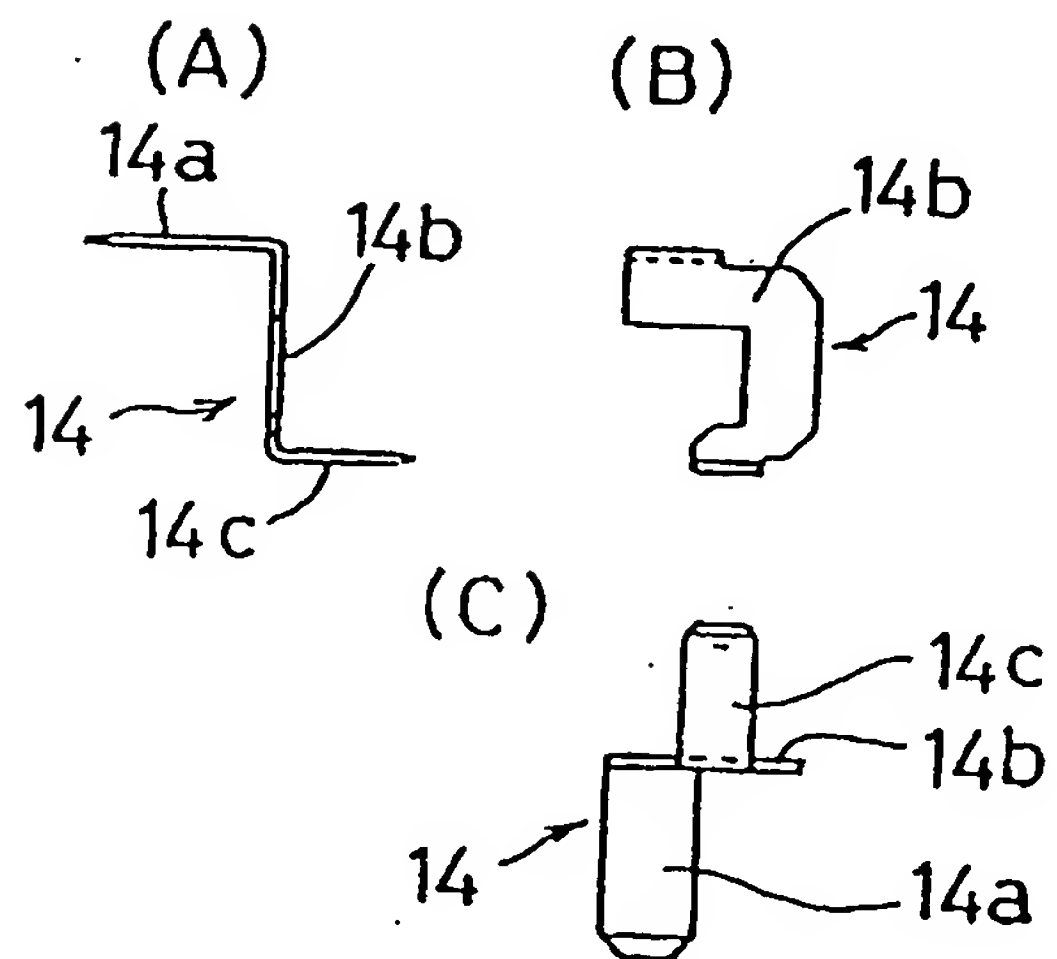




Fig. 6

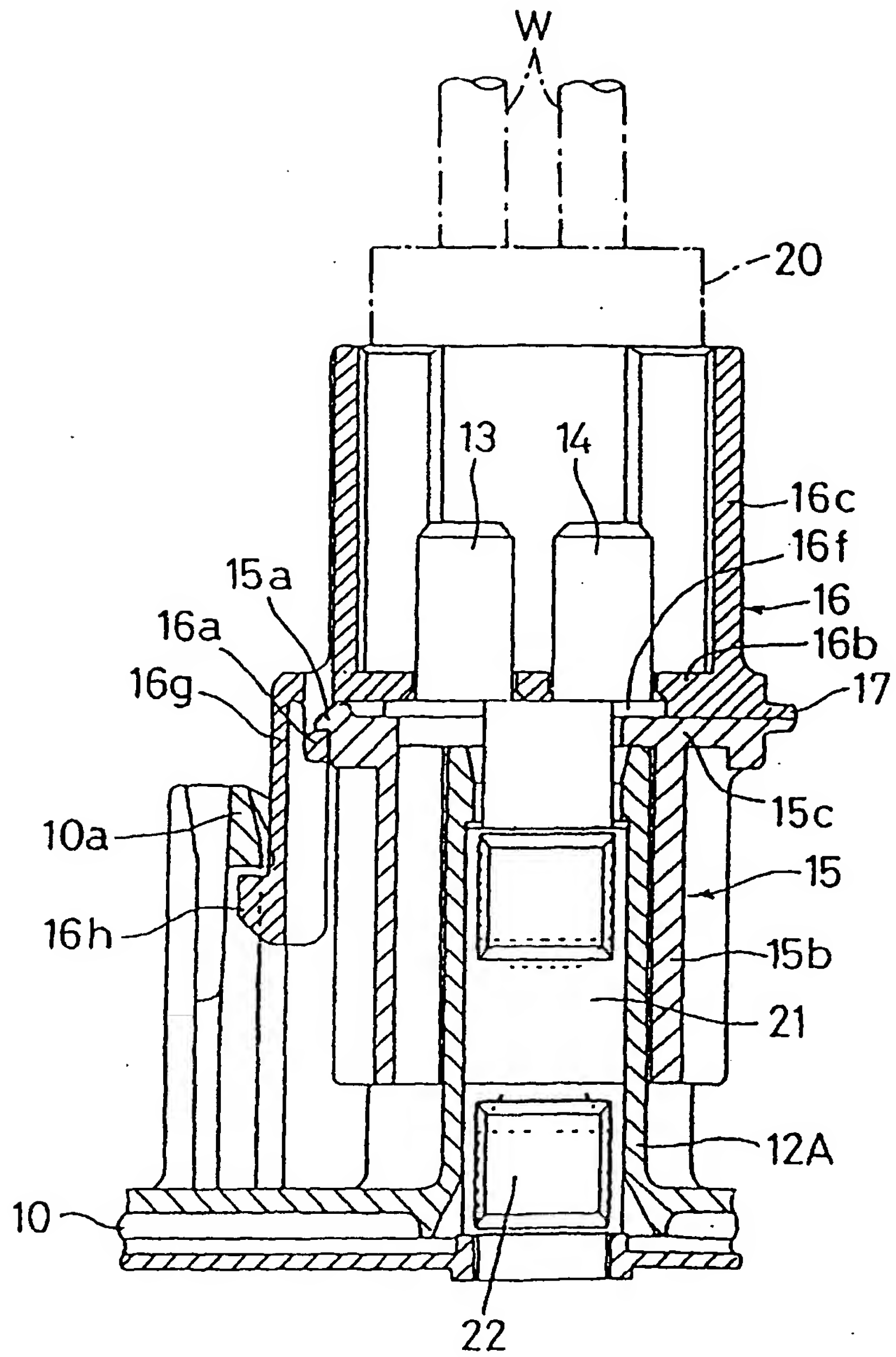


Fig. 7

